

## SECTION 550 – THERMOPLASTIC PAVING MARKING

### **550.01      DESCRIPTION**

This specification covers a reflectorized pavement striping material of the type that is applied to a road surface in a molten state with premixed glass beads by spray or extrusion means, with a supplemental surface application of glass spheres. Thermoplastic paving markings are to be used only on asphalt.

### **550.02      REFERENCE STANDARDS**

AASHTO	Specification M-247-81, M247 Type D
ASTM	D4796-88
FS	Federal Standard 595 Paint Specification
MSMT	Section 729
MSHA	Specifications, Section 549 – Pavement Marking

### **550.03      DEFINITIONS**

Not applicable

### **550.03      MATERIALS**

1. Reflectorized oil and grease impervious thermoplastic road marking materials that are either hot extrusion applied with a surface application of glass spheres and heat fused applied.
- B. Markings shall be reflectorized and able to durably resist degradation and deformation by traffic.
- C. The thermoplastic materials shall be homogenously composed of pigment, filler, resins, and glass reflectorizing spheres, and shall be available in both yellow and white.
- D. Composition: The pigment, beads and filler shall be uniformly dispersed in the resin. The materials shall be free from all skins, dirt, and foreign objects and shall comply with requirements according to Table 1. Only new materials shall be acceptable for use on this project.

<b>COMPONENT</b>	<b>WHITE PIGMENT</b>	<b>YELLOW PIGMENT</b>
Binder (see Note A)	18.0% min	18.0% min
Glass Beads (AASHTO M247 Type D)	30.0 – 40.0%	30.0 – 40.0%

Titanium Dioxide	10.0% min	--
Yellow Pigments (see Note B)	--	2.0% min
Calcium Carbonate	42.0% max	50.0% max

Note A: The alkyd binder shall consist of a mixture of synthetic resins (at least 1 of which is solid at room temperature) and a high boiling point plasticizer. At least 1/3 of binder composition shall be solid maleic modified glycerol ester resin and shall be no less than 8% by weight of the entire material formulation. The alkyd binder shall not contain petroleum based hydrocarbon resins.

Note B: The percentage of yellow pigment can be reduced if lead pigments are eliminated from the formulation.

- E. Temperature: The molten material temperature shall be between 400 and 440 degrees F unless otherwise recommended by the manufacturer, and approved by the M-NCPPC CM.
- F. Thickness: The pavement markings shall yield a solid thickness range of 80 to 95 mils above the roadway surface across the middle 2/3 of the line width when tested as specified in MSMT 729.
- G. Glass Beads: Glass beads shall be uniformly applied to the surface of the molten thermoplastic at the minimum rate of 7 to 9 lbs/100 ft<sup>2</sup>, as specified in MSMT 729.
- H. Color - The color of the dry markings shall match Federal Standard 595C
  - 1. Yellow: FS 13538, Orange Yellow/DOT Highway Yellow/ANA 506.
  - 2. White: FS 17886, Bone White.
- I. Retroreflectance: The millicandel/lux/square meter values taken anytime within the first 30 days shall conform to the following:

COLOR	RETROREFLECTIVITY	CORRECTIVE ACTION
White	equal to or greater than 250	None
Yellow	equal to or greater than 150	
White	less than 250	Grind or retrace.
Yellow	less than 150	

- J. The “Drop-On” glass beads shall conform to AASHTO specification M-247-81 except as follows:

The glass beads shall have the following gradation:

<b>US Sieve Number</b>	<b>Percent Passing</b>
20	100
30	75-95
50	15-35
80	0-5
100	0

- K. The “Drop-On” glass beads shall be smooth, clear and free from air inclusions. The beads shall have a minimum refractive index of 1.50 and shall be a minimum of 80% true spheres overall, and minimum 70% true spheres on each sieve. The beads shall be moisture proof coated and shall meet the requirements of AASHTO M-247-81 Section 4.4.2 to insure optimum embedment of 60%-65% in various thermoplastic traffic marking systems. The material shall set to bear traffic in not more than 2 minutes when the air temperature is 50 degrees F and not more than 10 minutes when the air temperature is 90 degrees F.
- L. Bond Strength: After heating the thermoplastic material for 4 hours at 425 degrees F, the bond strength to Portland Cement Concrete shall exceed 180 psi (1.24 Mpa Method ASTM D4796-88).
- M. Cracking Resistance: For at least 90 days after application the materials shall show no cracks other than substrate cracking.
- N. Smear and Softening Resistance: During the life of the materials, the applied markings shall not smear or soften apart from substrate movement.

**550.05            SUBMITTALS**

- A. The Contractor shall supply the specified color chips for the M-NCPPC’s use to visually determine that the thermoplastic material matches the specified color.
- B. The Contractor shall obtain and provide to the M-NCPPC Construction Manager, as part of the material submittal package, a written material specification compliance certification from the thermoplastic manufacturer, stating that the material being used on this contract meets the materials specifications in the Contract.

**550.06            QUALITY ASSURANCE**

- A. When applied properly and at the designated thickness and width the stripe shall, upon cooling, be reflectorized and resist deformation by traffic. The applied material shall be impervious to degradation by motor oil, diesel fuel, grease deposits and ice-preventative chemicals.

- C. Methods of Sampling and Testing: The Commission reserves the right to require the Contractor to perform any quality assurance testing necessary to determine compliance with these specifications. Testing required shall be by industry standard and shall be the responsibility of the Contractor and performed at no cost to the Commission.
- D. The thermoplastic pavement marking materials and glass beads furnished under this contract shall assume the manufacturer's warranty for these materials and shall be guaranteed by the supplier against failure due to traffic oil degradation.
- E. The contractor shall assume all costs arising from the use of patented materials, equipment, devices or processes used on or incorporated in the work, and agrees to indemnify and hold harmless the Commission and its duly authorized representatives from all suits at law or action of every nature for, or on account of, the use of any patented materials equipment, devices or processes. Further, the material shall meet the requirements of this specification for a period of one year.

#### **550.07            CONSTRUCTION**

Construction shall meet all requirements of MSHA Section 549.

##### A. Pre-Marking of Lines.

1. When a line is required to be placed in the same location as an existing painted line, and existing painted markings not required to be removed are visible, they shall be retraced (i.e. new markings installed in exactly the same locations, patterns, and dimensions as the old markings).
2. If the existing markings are to be removed or are not visible, or if new roadway surface has been placed before markings installation occurs, or if the contract requires a line to be installed where none currently exists, the Contractor will be required to pre-mark as directed by the M-NCPPC Construction Manager and subsequently shall install the required markings in accordance with the requirement of other sections of the specifications.
3. The actual placement of the pavement markings at any such site shall not be performed until the pre-marking has been inspected and approved by the M-NCPPC Construction Manager.

##### B. Removal of Existing Plastic or Painted Markings

1. When called for in the Contract or otherwise as directed by the M-NCPPC Construction Manager, removal of existing painted or plastic pavement markings shall be accomplished by the Contractor using equipment and methods specifically approved by the M-NCPPC Construction Manager. Marking removal shall not be "painted out" with black paint nor shall it result in excessive scarring of the pavement. No more than 1/8 inch depth of scarred pavement will be allowed. At least 90% of all markings shall be removed. Contractor shall remove of all debris caused by marking removal and dispose of properly.

2. Unless directed otherwise by the M-NCPPC Construction Manager, new markings must be applied on the same day as removal of old markings from the same location. Whenever grinding, scraping, sandblasting, or other operations are performed, the work shall be conducted in such manner that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect motorists. When these operations are completed, the pavement markings shall be cleaned to remove residue and debris resulting from the cleaning work.
3. The Contractor shall be responsible for removing any marking that is improperly located or otherwise incorrectly applied.
4. Marking removal being performed within ten feet of an active traffic lane shall be done by methods previously approved by the M-NCPPC Construction Manager.
5. Any damage to the pavement or pavement joint materials caused by pavement marking removal shall be repaired by the Contractor at no cost to the Commission by methods acceptable to the M-NCPPC Construction Manager.

#### C. Application Requirements.

1. Temperature: The molten applied thermoplastic material shall readily screed/extruded at temperatures between 400 degrees F and 440 degrees F from the approved equipment to produce a line that is continuous and uniform in shape having sharp edges.
2. The pavement shall be dry with no surface dampness, dew, or subsurface wetness. Both the ambient and surface temperature must be at least 55° F before application.
3. Method of Application: The Contractor shall furnish and install machine-applied extruded and/or sprayed hot thermoplastic with glass spheres (pre-mixed and drop-on) in the proper ratio to immediately produce a highly reflective marking as described elsewhere in these specifications, in accordance with the details in this contract and the following provisions.
4. Surface Preparation: In order to ensure maximum possible adhesion, the pavement surface upon which the pavement markings are to be placed shall be properly cleaned from grease, oil, mud, dust, dirt, grass, loose gravel, and other deleterious material prior to the application of the Thermoplastic Pavement Markings, and/or primer/sealer. Cleaning is required on all surfaces that are to receive new pavement markings, and shall be considered incidental to the application of the markings.
5. Primer-Sealer: It shall be the responsibility of the Contractor to recommend to the M-NCPPC Construction Manager and obtain the M-NCPPC Construction Manager's concurrence as to whether primer/sealer is required on a given pavement in order to meet the material manufacturer's warranty conditions. Generally, on all Portland cement concrete pavement surfaces and aged asphalt-concrete pavements having less than 80% bituminous concrete, primer/sealer shall be applied to the area where the thermoplastic pavement markings are to be placed. Also, the Commission reserves the right to direct the Contractor to apply primer/sealer for any given markings.

6. The primer/sealer shall be that which is recommended by the manufacturer of the thermoplastic material, and approved by the Construction Manager. The material shall form a continuous film that dries rapidly and adheres to the pavement. The material shall not discolor nor cause any noticeable change in the appearance of the pavement outside of the finished pavement markings. All solvents shall have evaporated from the primer/sealer prior to the application of the molten thermoplastic materials. A sample of the primer/sealer and the recommended method of application must be submitted to the M-NCPPC Construction Manager, and shall have been approved by the M-NCPPC Construction Manager and the manufacturer of the material before application.
7. The M-NCPPC Construction Manager has the authority to require the Contractor to apply the primer/sealer using a separate vehicle which may require additional traffic control.
8. Additional Glass Beads: The application of additional glass beads by drop-on methods shall be at a minimum rate of 8 lbs. per 100 sq ft of marking. Ambient and surface temperatures shall be at least 50 degrees F and rising at the time of application.

**550.08            METHOD OF MEASUREMENT AND PAYMENT**

- A. Payment will be full compensation for all material, labor, equipment, tools, and incidental items necessary to complete the work. Payment shall be made on a unit rate or lump sum basis as shown in the bid proposal.
- B. Maintenance of traffic for this work will be paid under the Maintenance of Traffic item if an item is included in the bid proposal, otherwise it will be considered incidental to the work.
- C. The removal of pavement markings will be measured and paid for at the contract price as shown in the Bid Documents. No direct payment will be made for the removal of existing pavement markings that have not been authorized by the M-NCPPC Construction Manager.
- D. Pre-marking is incidental to the pavement marking installation work and there will be no separate payment for pre-marking.